Traveling with Success

How Local Governments Use Intelligent Transportation Systems

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Dear Reader,

Cities, counties and metropolitan areas across the country are spending millions of dollars on individual Intelligent Transportation System (ITS) technologies. Yet, very few have designed and implemented these systems in such a way as to integrate them with future systems.

The federal government, through the U.S. Department of Transportation, has launched a national campaign to integrate application of these ITS technologies. This initiative has been termed "ITS Core Infrastructure," and it provides the building blocks needed to combine two or more of the following technologies which may already be in place in your own jurisdiction:

- traffic signal control systems;
- freeway management systems;
- transit management systems;
- incident management systems;
- electronic fare payment systems;
- electronic toll collection systems; and
- multimodal traveler information systems.

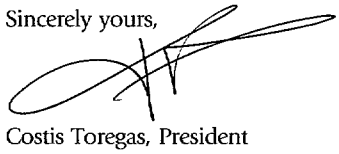
Integrating these technologies among your public safety, traffic, transit, and other departments will improve mobility and safety throughout your region. It will not only enhance communication and cooperation among departments, but will also increase economic development opportunities in your community.

Metropolitan areas need to "buy smart" to achieve the benefits of an ITS core infrastructure: reduced congestion, real-time information on public transit services, faster emergency response, and improved quality of life.

PTI's partnership with the U.S. DOT Federal Highway Administration aims to increase local government awareness of the benefits of using these ITS core infrastructure principles. This booklet of ITS local government success stories is one product of our outreach campaign. It reflects individual achievements of communities across the country as they apply aspects of the core infrastructure concept locally. Three examples at the end of the booklet illustrate successful results of combining several transportation systems into one efficient core infrastructure network.

We hope you enjoy the book, and encourage you to find out more about how you can begin "traveling with success!"

Sincerely yours,



Costis Toregas, President
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Background and Mission

Traveling with Success: How Local Governments Use Intelligent Transportation Systems was produced by Public Technology, Inc. (PTI), with funding from the U.S. Department of Transportation's Federal Highway Administration (FHWA). Telling the stories of thirty-one successful local government intelligent transportation systems (ITS) initiatives, the booklet represents an effort to increase awareness and use of ITS at the local level.

PTI is the non-profit technology organization of the National League of Cities, the National Association of Counties, and the International City/County Management Association. Through collective research by its member jurisdictions, ITI creates and advances technology-based products, services, and enterprises in cities and counties nationwide.

PTI's membership includes the Urban Consortium (UC), a special net-work of the nation's largest cities and counties. Working in four task forces-Transportation, Environmental, Energy, and Telecommunications and Information-UC jurisdictions identify and test new solutions to common concerns and share their findings with a wide audience of local governments, large and small.

The **UC Transportation Task Force** guides MI's Local Government Intelligent Transportation Systems Program, which ties advanced transportation technology research, planning and implementation activities to the needs of local government. Through this program, city and county officials work actively with federal ITS decision-makers and private technology firms to develop a nationally compatible lTS architecture and to ensure that new ITS applications meet local requirements.

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Traffic Management

1 Coordinating Traffic Signals and Patterns

Decades of steady growth overwhelmed Hillsborough County with traffic congestion. Roadway construction and widening the primary methods used to alleviate traffic congestion, were disruptive to the community and extremely expensive to the county.

"Smart" traffic signals reduce costly construction

With a management information system for traffic (MIST), Hillsborough County created "smart" signals. From a central control room, engineers now observe and communicate with an entire network of traffic signals to change timings as needed and coordinate them across road systems countywide.

Signal timings are adjusted from MIST central approximately five times each day to adapt to changing traffic conditions. Also, surveillance cameras survey traffic patterns and alert engineers to bottlenecks and delays so they can take remedial action.

The groundwork for MIST began several years ago with the installation of interconnect cables between various traffic signals. These cable systems quickly became a standard requirement for all roadway and signal construction projects. Today, they link most of the county's 350 traffic signals.

Coordinating signals minimizes Stops and maximizes traffic flow

Early results suggest that MIST maximizes roadway capacity. Signal coordination enables motorists to drive through high-volume traffic areas with minimal stops.

For more information:

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SCOOT Over, Old Technology

In the past , traffic signals in the city of San Diego operated on fixed cycles for several hours at a time. Signal timing fluctuated only with rush versus non-rush or weekday versus weekend periods and reflected only peak flow in each of those periods, failing to keep pace with constantly changing traffic conditions. Not surprisingly, the system travel, adverse weather conditions or diverted flow.

New signal controls automatically Respond to changes in traffic flow

San Diego's new signal-control system, the Split, Cycle, and Offset Optimization Technique (SCOOT) responds automatically to variations in traffic flow, based on real-time information fed from detector s embedded in city roadways. A central minicomputer communicates once per second with SCOOT intersections, recalculating signal timing based on the up-to-minute information it receives.

Optimal signal timing reduces travel times and vehicle emissions

SCOOT is currently concentrated on two city roadways . One is a six-lane major arterial serving commercial and light-industry areas as well as the Miramar Naval Air Station . The other provides access to San Diego's stadium, home to approximately 250 event s each year.

After San Diego evaluate s these initial installations, the city will expand the SCOOT system. So far , result s are encouraging other areas with SCOOT systems report significant reductions in travel times, with decreases of up to 11 percent during peak periods.

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Changing the Course of Urban Traffic

Continued growth in the northern and eastern sections of Dallas, coupled with reconstruction of U.S. 75, the major freeway serving the area, choked traffic on local roads, creating a critical need for short- and long-term solutions to congestion. Some widening of existing streets at the newer and less developed northern end of the travel corridor was possible. Closer to the city's core, however, where neighborhoods tended to be older and more congested, a more creative use of existing infrastructure was necessary.

Lanes reversed to accommodate flow at peak traffic periods

Now, with the aid of reversible-lane technology, roadways in two of Dallas' busiest corridors temporarily reassign traffic flow on specific lanes, effectively doubling the number of lanes in the peak direction during morning and evening rush. In those periods, the five-lane roadways dedicate four lanes to the peak direction-reserving one for left turns-and the fifth to the opposite direction. At other times, the roadways devote the usual two lanes to each direction, and the middle lane to left turns. Each shift takes approximately 10 minutes.

Managed from remote locations at the traffic operation center, "smart" 24-by-30-foot overhead electronic signs, placed an average of every 1,000 feet, alert motorists to the gradual switch of lane direction by displaying an amber "X" in a lane about to change direction and a red "X" once the shift is complete. Each smart sign mechanism is internally programmed with timing sequences; all report to a control center, where computers monitor and synchronize activity and alarms signal any problems. In addition to the smart signs, regular information signs on the parkways and guide markings on the pavement provide clear instructions to motorists.

Rush-hour capacity increased by 33 percent- with no new construction

With a capital expense of $1.2 million, Dallas increased the rush-hour capacity of two older thoroughfares by 33 percent for the peak direction. The city's reversible-lane program also decreases congestion, pollution, and travel times, as it allows motorists to choose alternative routes during the ongoing reconstruction of the major freeway, scheduled for completion in the year 2000. Minimizing delays and inconvenience to commuters and businesses, the efficient and cost-effective system has enhanced access to downtown Dallas.

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Betting on Traffic Management: A Regional Approach

When the Las Vegas Area Computer Traffic System (LVACTS) was launched in 1983, it was one of the few centralized multi-jurisdictional computerized traffic-signal systems in the country. Since that time, the Las Vegas Valley has experienced tremendous growth-with annual increases of over 15 percent. Improvements have expanded roadways to meet traffic demand, but the system has reached capacity, as has the mainframe computer controlling the region's traffic signals. The latter no longer can accommodate new traffic signals.

Decentralized traffic-signal system operates reliably and expands easily

Las Vegas' traditional centralized signal system depended on a large main frame computer and very reliable communications between the computer and the intersection controls. A network of inexpensive but powerful microcomputers (housed within each traffic-intersection controller) will be the focus of the new system, which is organized into multiple hubs. If an intersection makes a signal adjustment based on traffic conditions, this information is passed along automatically to other intersections within its subsystem and to its local "headquarter" hub. This hub reports the adjustments to the main computer, which, in turn, "talks" to regional hubs, tying into the overall communications system. Since information travels in a loop, signal operation is reliable even if one communications link fails. And in a decentralized, networked system, computer capacity can expand as needed to accommodate new intersections.

Communications is key to coordination and operation

Closed-circuit video, another feature of the new system, allows operators to observe traffic conditions across the Las Vegas Valley from a traffic management center-and adjust traffic flow region-wide-rather than travel to make on-site inspections. The result is a system that combines best of both worlds: local control and central surveillance, working in tandem to improve traffic operations and air quality throughout the area.

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Smile. You're on Coliseum Camera.

Significant traffic and parking problems at Winston-Salem's Lawrence Joel Veterans Memorial Coliseum increased congestion on surface streets leading to the arena, delaying patrons' arrival for scheduled events-and making for unhappy customers. Studies indicated that roadways could adequately accommodate normal traffic, but Coliseum events strained traffic capacity. And, human nature being what it is, most people tended to arrive close to the scheduled start of the event, increasing traffic volume even more than usual.

With attention divided among multiple driveways stemming from three roads, parking attendants found it difficult to keep track of the number of available parking spaces and to efficiently fill the lots. Lacking adequate communication with police directing traffic, Coliseum employees were forced to go to the lots in person, assess parking and street traffic conditions, and decide whether they should close the gate to the main lot and divert traffic to adjacent lots.

Monitoring cameras allow management of traffic flow

To tackle the problem, the city mounted three traffic-monitoring cameras with recording capabilities on the roof of the Coliseum, giving management a central, bird's-eye view of parking operations and traffic flow on roadways approaching the arena. The city purchased the monitoring equipment at a cost of approximately $80,000. Now, Coliseum operators can visually assess the capacity of lots and notify the police sergeant, via radio, to close particular gates and divert traffic to specific lots. This coordination is a small but important step in sharing the information needed for smooth operation.

Streamlined systems eliminate delays and make parking a breeze

Since installation of the cameras, no significant traffic delays have frustrated Coliseum patrons. By recording traffic flow at major events, the system also enables management to plan effectively for future events. AS an added bonus, the camera system offers increased security for patrons-many of whom had found parked cars burglarized in the past-and parking attendants-often responsible for large amounts of money and concerned about the possibility of theft. The video cameras can record crimes-in-progress and zoom in, when necessary, to capture the license plate of a vandal or robber.

For more information:

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Planning an Urban Rose Garden

The Rose Garden, Portland's new 20,000-seat arena, is springing up next to the existing 12,500 seat Coliseum and near the new Oregon Convention Center. Development of a major project in this already congested downtown area poses traffic management and parking challenges.

Planning, coordination, and built-in traffic management tools

Portland is addressing these challenges with technology. Internal surveillance cameras will monitor activity throughout the stadium, enhancing security; seven exterior cameras-with full zoom, tilt, and pan features-will assess traffic conditions on adjacent roadways All cameras will feed information to a small yet fully equipped traffic operations center in the basement of the arena. The exterior video cameras will also feed data to two off-site traffic operation centers, the city of Portland's and the state Department of Transportation's, although only one operation center at a time will actually be able to monitor traffic conditions. Variable message signs (electronic signs flashing up-to-date instructions-in this case, reflecting data captured by the cameras) will be installed on interstate ramps feeding into the area.

Making it work with partnerships

The city of Portland and the private developer of the Rose Garden are funding the technology to alleviate traffic congestion at the arena. Joining these organizations is the Oregon Department of Transportation, which recognized in the arena project an opportunity to manage traffic on the adjacent freeway system.

In addition to implementing advanced technology to reduce congestion, management will limit overlapping special functions and avoid starting and ending events during peak traffic hours. A shuttle bus operation plans to transport patrons to the Rose Garden from commercial parking spaces-often empty after 5 p.m.-within a half-mile radius of the arena. Management may also sell parking spots with event tickets to prevent last minute confusion on event days. With technology and common sense, Portland is planning ahead to prevent traffic and parking problems.

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Parking Solutions

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Open Sesame: "Smart" Tags for Parking Access

The Louisiana State University (LSU) Medical Center in New Orleans watches thousands of people-doctors, professors, students, patients, and visitors-come and go every day. The medical center's parking system alone handles 5,000 users daily.

In the past, access to the center's parking areas was controlled by magnetic-stripe-card readers. The readers, however, began to erode, due, in part, to New Orleans' hot and humid weather and, in part, to built-up dirt and grime within the mechanisms themselves. Errors were common. Even when the system functioned properly, it slowed traffic to a crawl at lot entrances and exits-especially during peak workday periods.

System automatically identifies eligible cards and grants access

The LSU Medical Center's new parking system uses wireless communications technology to control access. Mounted inside a vehicle's windshield with Velcro strips, a programmable tag-about the size of a thick credit card-stores user identification and authorization information. As a vehicle approaches within 12 to 16 feet of a reader, the system makes identification in one-tenth of a second. Within one second, the gate opens and allows the vehicle access, never requiring the vehicle to stop.

Customer-convenience-and-security system works like a charm

There are no access cards to find and no card readers to maintain: the tag does it all. Eliminating the need to stop or open one's vehicle, the "smart" tag has been a tremendous success, speeding up entry and exit at parking facilities during peak hours. With student registrations, graduations, and staff turnovers likely to snarl parking-lot traffic, the system needs to be-and is-extremely flexible and easy to re-program. It assigns access to individuals by specific lots and for various periods.

The system also boasts several enforcement features. It electronically reports any attempt to use an invalid tag to university police, giving the location of the attempted entry and the name and card number of the violator. And an anti-pass-back option requires the "smart" tag to exit before reentering the system, making it impossible for one user to pass a tag back to another.

For more information:
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Brainy Parking Meters

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Located in historic Bucks County, New Hope is a small community known for its artisans, quaint shops, antiques, and restaurants. Since tourists and locals flock to this popular destination, parking is at a premium. The borough of New Hope relies on parking meters to provide convenient short-term parking for shoppers and visitors-and on income from meter- and parking-violation fees as an important source of revenue.

New meters automatically reset to zero, preventing costly rip-offs

New Hope is testing new, "smart" meters in its most traveled areas. Using software and sensing technology, the intelligent parking meters-which look like regular meters, but contain small computers-immediately recognize a vehicle's departure from a parking space and reset themselves to zero, preventing non-paying customers from occupying a space with leftover meter time. Programming options can stipulate the maximum amount of time at each meter. Penalty enforcement for parking violations is easy-a bright red light indicates that paid time has been exceeded. And for those who see a meter maid and plead for mercy, saying that time just ran out a minute before, the meter indicates the exact time of expiration.

Community collects more revenue without raising parking rates

To date, the smart meter test is working well in New Hope. Since those who use intelligent meters pay their fair share, revenue generated from these devices exceeds the average collected from their traditional counterparts, allowing the borough to avoid raising parking rates or expanding the hours or days of required meter payment. As an added bonus, the meters track valuable information on usage, revenue, and violations by location.

For more information:

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Borough of New Hope, Pennsylvania
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Finding the Key to Cash and Convenience

Revenues generated by parking (meters, permits, and fines) add up to a big hunk of change for a small community like West Hollywood: an estimated 20 to 25 percent of the city's income. But with approximately 1,800 parking meters to maintain and monitor for violations, West Hollywood found itself strapped for service and enforcement staff.

Customer cash key pays meter electronically

New parking meters, easily programmable for different time limits and parking rates and capable of accepting electronic keys worth $10 to $100 in paid parking fees, solved the city's problem. Customers insert the cash keys and turn them the desired number of times to pay for parking. Each time a key is used, a digital read-out of its cash balance, rounded to the nearest dollar, is displayed. The meter will accept parking tokens or coins of any denomination in lieu of the electronic keys.

Collecting advance payment and information for resource management

By selling meter time in advance, West Hollywood collects revenue up front and in greater increments. A microchip in each meter tracks the amount and rate of collection to project the total coinage the meter will receive on a given day, the number of pick-ups needed, and the times when parking enforcement is most critical. These features reduce the possibility of theft and maximize the city's use of resources and staff.

An adjacent community-Beverly Hills-is considering conversion to a cash-key system that meters there and in West Hollywood could use. With the microchip keeping an accurate tally of use, the amount due to each community-meter by meter-could easily be computed and credited.

For more information:
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Mass Transit

10 Transforming the "T"

America's oldest transportation system, the Massachusetts Bay Transit Authority, better known in the Boston area as the " T " comprises buses, streetcars, rail, boats, and vans. Moving 700,000 people a day, the system plays a crucial role in the area's economy. Like many other organizations in economically depressed Massachusetts, the authority has found its budget slashed but its expected level of service raised.

Quality-of-life improvements people can see, feel, and hear

The purchase of state-of-the-art trains for the T's Red Line signaled a new era for the transit system. The "smart" trains boast enhanced communications capabilities: unusually clear pre-recorded audio announcements, triggered on approach to an upcoming station, complement traveler information displayed on electronic message screens. The trains also feature advanced microprocessor diagnostics to pinpoint any malfunctions.

Dramatic differences include a one-third drop in serious crime

In another technological step toward passenger-friendly transit, the T cooperated with Boston police to electronically analyze crime trends within the transit system, identify hot spots of criminal activity, and direct patrols to target these areas. The results are impressive: over a two-year period, serious crime declined system-wide by more than one-third.

By implementing new technology and reorganizing transit functions more efficiently by bus, rail, and other modes, the T has seen dramatic increases in equipment reliability-measured, in transit terms, as the distance between failures on every mode-and enhanced passenger safety and security. Boston has discovered that if a transit system is reliable, safe, clean, and communicates with its customers, people will use it.

For more information:

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Taking the Guesswork out of Bus Schedules

As the Twin Cities area has grown, so have its traffic congestion woes. Encouraging commuters to use public transit instead of single-occupant cars is one answer to the problem. But for mass transit to be an attractive alternative, it must be more efficient Riders, usually left to guess if a late-running bus is around the corner or has been taken out of service, complain most often of transit's unreliability.

Dispatchers track buses' real-time progress and exact location

Through Minnesota Guidestar's Travlink project, a partnership of public, private, and academic institutions, buses are equipped with devices that drivers use to log on and receive their route assignments, with schedule details. As a bus travels along its route dispatchers use electronic maps to monitor the real-time progress and location of the, bus-pinpointed within a city block. (A satellite-based global positioning system shares this information automatically between buses and the dispatch center.)
Colored icons identify the status of the bus, indicating whether it is on time, early, or behind schedule. With this system, dispatchers can adjust problematic route schedules quickly, reducing the incidence of bus "bunching" and improving on-time service.

Drivers can also use a pre-programmed control panel to communicate quickly with the dispatch. Instead of talking a driver might punch a key to signal mechanical difficulty, or a special emergency key to activate a silent alarm that summons help.

Information shared instantaneously with bus riders

Electronic signs at three commuter park-and-ride lots display real-time bus status messages. Commuters can wait in their cars until their buses approach-a very user-friendly feature, considering Minnesota's harsh winters. Touch-screen kiosks also present real-time information. Travelers can use the kiosks and special videotex terminals to check the status of their buses, plan their routes, print schedules, find out about carpools, and access the latest traffic and road information.

For more information:

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Smart Bus Farebox Collects Fares and Information

The city of Phoenix transit system has numerous fare categories, offering discounts to seniors, youth, and persons with disabilities and exacting premiums from rush-hour passengers. In the past, passengers paid fares with cash, tokens, or transfers-requiring drivers to verify amounts paid and signal fareboxes to "dump" their contents into their vault components. The system was especially cumbersome in heavy-volume periods, creating bottlenecks of passengers trying to board buses and pay.

Sophisticated fareboxes take credit cards and a special smart card

Passengers now enjoy the convenience of paying with Visa or MasterCard instead of fumbling for correct change. Phoenix's new smart fareboxes accept these major credit cards as well as the transit system's own BusCard Plus, which local companies distribute to interested employees, paying for up to one month's usage at a time and recouping the cost (or a portion there of) through payroll deduction. The farebox software determines if a card is valid. If it is, the passenger gets an audible electronic "thank you"; if not, the farebox rejects the card and requests another form of payment. The farebox software adapts nimbly to different fare categories and adjusts easily to reflect fare increases.

Fareboxes keep accurate count of money and people

Phoenix's smart fareboxes have ensured that passengers pay their fair share for bus rides. While collecting fares, the boxes also gather valuable ridership data, including a count of passengers as they board. A special probe transfers this data rapidly and regularly to the farebox.

As part of a travel reduction program geared toward improving Phoenix's air quality, many companies are subsidizing transit costs for their employees through BusCard Plus. With 10,000 to 15,000 passengers regularly using the smart card, Phoenix is seeing another benefit: less cash is carried on buses, reducing opportunities for theft.

For more information:

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City of Phonix, Arizona
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Improving Transit Productivity and Operating Costs

Facing a funding squeeze and the accompanying need for greater efficiency, the Kansas City Area Transportation Authority turned to technology for answers. To track its fleet of 280 buses, the authority installed an automatic vehicle locator (AVL) on each, and "smart" signposts along the roadways to read and communicate bus locations directly to the computer-aided dispatch center.

Dispatchers and drivers work together to stay on schedule

At dispatch headquarters, a console monitors the real-time, precise position of each bus and compares it with the bus' planned route and schedule. Dispatchers can focus on those buses that are ahead of or behind schedule and make appropriate adjustments. A digital read-out in each bus provides the driver with the same real-time information, indicating whether he or she is running early or late on the scheduled route. The system also equips each bus with a silent alarm for emergency communications.

Operating in real time improves "on-time"

Under the AVL system, on-time performance of the transit system rose from 78 to 95 percent. Buses on schedule 95 percent of the time are more reliable and, consequently, more attractive to commuters and other customers. With this greater efficiency, Kansas City was able to eliminate seven buses from its routes without adversely affecting service to its passengers-and save over $400,000 annually in operating expenses. The system provided another benefit-fast response in the event of crime, medical emergency, or other crisis. By pinpointing bus locations, the system slashed a response time of three to 10 minutes to approximately one.

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14 High-Tech Transit Keeps the Big Apple Moving

New York City relies on transit to move millions of people every day. 800,000 cars travel daily into New York's central business district yet the majority of commuters stream into downtown on buses, ferries, and light and heavy rail. A staggering 75 percent of New York's eight million people use and rely on mass transit. Given their city's unusual variety of transportation modes, New Yorkers need precise and up-to-the-minute information to assess options. But, before New York transit authorities can share information with consumers, it must first exist within the system. Since 1904, the city sub-way's signal network has operated with unchanging technology, basing subway routing decisions on second-hand information obtained from calling towers and radio operators. This is all beginning to change.

Technology and information answer consumer needs

With the transition to new technology, a control center will monitor the exact location of each train. Already, an automated central system dispatches and tracks all trains from Grand Central Station to the Bronx. Microprocessor technology and fiber-optic communications lines convey real-time arrival and departure information.

Technology is also transforming the city's bus service. By tracking its fleet of buses with satellite technology, New York will minimize a phenomenon known as bus "bunching," which occurs as fluctuating bus rider-ship and traffic cause several buses to arrive at a stop together and no buses at all to show up for extended periods of time.

To offer commuters and visitors the information they need to choose transit modes and the convenience they need to navigate a complex system, the city plans to introduce interactive kiosks and a user-friendly MetroCard for fare payment on buses, trains, ferries, and subways.

Better service boosts consumer confidence

Better communication and better service enhance public trust in the system- and public perception of security. In the last four years, felony crime in New York's subway system has fallen approximately 50 percent, encouraging more travelers to use transit. Late-night waits in subway stations will be even less worrisome when electronic signs tell riders exactly when a train is expected to arrive.

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Incident Management

15 Faster Incident Detection Means Faster Response

Like those of many major cities, San Antonio's freeway system is heavily congested. Contributing to this chronic congestion are accidents and highway incidents in both peak and non-peak periods. During non-rush periods, road construction and ongoing maintenance aggravate traffic problems.

Technological tools alert officials and suggest solutions

San Antonio's advanced traffic management system, TransGuide, relies on technology to rapidly identify freeway accidents and incidents. Detectors, placed in each lane at half-mile intervals, accumulate vehicle data (such as changes in speed) indicating normal or impeded traffic flow. High-resolution color video cameras equipped with remote zoom and focus features can zero in to visually investigate and evaluate incidents. At the heart of the TransGuide system is a mainframe computer that controls detection, analysis, and response. The mainframe database can search some 34,000 pre-programmed solutions to identify the most appropriate response to a given incident. (Ultimately, the database will store up to 128,000 such solutions.) In most cases, within 15 seconds of an alarm identification, traffic engineers can order the system to execute its suggested response. Systems continue to monitor roadway data as an incident progresses and clears. A stalled vehicle on a freeway shoulder might impact only an adjacent lane, but a major accident could affect all variable message signs, count-less lane-control signals, and signal timing-rerouting traffic for miles. San Antonio's TransGuide slashes the time required to make these adjustments and synchronizes the changes to optimize traffic flow across the freeway system.

TransGuide makes travel safer and easier

In addition to reducing congestion, TransGuide's fast response will save lives. Within less than three minutes of an incident's occurrence, police or other specialized personnel are able to respond. Ten years from now, according to projections, the system is expected to deal with an average of 191 incidents per hour-one incident per mile per hour. Efficiency, coordination, and rapid response will be even more important-and TransGuide will be ready.

For more information:

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Texas Department of Transportation, San Antonio District
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Looking for Incidents from the Ground Up

Located in the Washington, D.C., metropolitan area, Montgomery County gets its share of urban traffic. In its own night, too, the county has under-gone tremendous residential and commercial growth, boasting a population of 800,000 and 3,000 miles of roads. With the growth have come congestion, environmental concerns, and other skills-such as increased incidents-that reduce the capacity of the county's transportation system.

Technology grapples with the unexpected

Nationally, 60 percent of delays on urban roads are attributed to incidents that bring traffic flow to a standstill: disabled vehicles, accidents, debris on the roadway, or overturned trucks carrying hazardous materials. To rapidly identify and dear incidents, Montgomery County has established an advanced transportation management system that supports up to 1,500 traffic signals, 200 video surveillance cameras, and 3,000 sampling detectors in the roadways. Enhancing the monitoring capabilities of this system with a critical birds-eye view is an aerial surveillance program, in action each morning and afternoon, that transmits live video footage of incidents and bottlenecks directly to the county's transportation management center.

Emphasis on communications benefits all concerned

Staffed with a pilot and a traffic technician, a government airplane circles the county, spotting incidents and quickly identifying their locations and circumstances. This instantaneous and precise information, fed automatically to the police and fire computer-aided dispatch system, alerts emergency agencies to the need for immediate response. The real-time information may also direct the transportation management center to optimize traffic flow with changes to traffic signals and variable message signs.

During snowstorms or other crises, the transportation management center takes over a local cable television channel and updates conditions around the clock with video footage from aerial and ground cameras, sharing real-time traffic information with the traveler Radio also broad-casts current traffic conditions.

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Traveler Information

Test-Driving the Future 17

To determine the usefulness of advanced in-vehicle navigation and information systems for drivers, Orlando launched the TravTek (Travel Technology) project. The test involved approximately 100 vehicles-mostly rental cars-equipped with electronic guidance systems. Some 4,000 drivers, the vast majority tourists, participated in the trial.

Putting route guidance and travel information at the driver's fingertips

The in-vehicle systems, loaded with databases, featured a navigation map showing all roads in a five-county, 1,200-square-mile area as well as an American Automobile Association (AAA) Florida TourBook and Orlando tourist information on hotels, restaurants, attractions, and special events.
Touch-screens allowed drivers to do everything from search for Italian restaurants to map the route from Orlando's airport to their hotels. Once a specific destination was selected, the system automatically calculated the best and fastest route to that destination, factoring in real-time traffic conditions. On-screen maps displayed easy-to-follow, turn-by-turn driving directions for the prescribed route, along with the calculated distance and estimated travel time to the specified destination. Verbal instructions were also available to drivers, as were cellular phones for emergency help or additional information. Built-in magnetic compasses, satellite technology, and sensors in the wheels (to measure distance traveled) all kept vehicles on their established course.

TravTek gets travelers to their destination faster and more safely

Thanks to the system's extreme ease of use, novices operated it fully after just a brief orientation. Orlando has compared results from the TravTek trial to those of control tests in which drivers used standard printed road maps to find their way. Overall, the city found, TravTek reduced travel time by 19 percent-and helped drivers make fewer accidents.

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Shaking Up Commuters 18

Plagued by smog from vehicle emissions, Los Angeles has tried-for some time-to encourage the use of mass transit and ridesharing among local travelers. To motivate a switch to earth-friendly transportation, the city decided, through the California Smart Traveler project, to inform the public of high-occupancy transportation alternatives.

After the shock, traveler information in demand

Three information kiosks using audiotex and videotex were originally planned for the project. When a 1994 earthquake destroyed major roads and forced many commuters to investigate alternative routes and modes of transportation, however, the number of kiosks exploded to about 80 to accommodate the sudden information demand. Located in shopping malls, public buildings, business parks, and gathering places such as the YMCA, the kiosks allowed travelers to plan transit trips, find carpools, view traffic conditions on the freeway system, and print itineraries.

Smart travelers could also dial in, via personal computers and modems, for real-time freeway conditions captured by roadway loop detectors. And an expanded 800 number offered information on bus and rail transportation across Southern California.

New tools are a hit with local commuters

Over one year after the earthquake, kiosks usage remained high, averaging over 60,000 inquiries a month. Although Los Angeles removed the kiosks once recovery seemed sure, popular demand has since brought them back, and the city will soon return the kiosks to their former locations. The 800 number also shows impressive usage, averaging 20,000 to 30,000 calls per month. Future plans call for dissemination of freeway information on the Internet's World-Wide Web.

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Putting Information in the Urban Traveler's Hand

Commuters in the Twin Cities area daily combat congestion on freeways and major arterials, often in an information vacuum. To determine whether access to real-time data would help urban commuters travel smarter, the cities of Minneapolis and St. Paul are testing an advanced traveler information system known as Genesis.

Standard communications, unprecedented information

The Genesis system-just one element of the state of Minnesota's integrated transportation system, Guidestar-uses increasingly common personal communications devices, such as pagers and Apple Newtons with paging cards, to disseminate information when and where travelers need it. Real-time information on traffic conditions is gathered continually by roadway sensors and closed-circuit cameras. Operators at the local traffic management center receive the data, evaluate it, and announce roadway incidents on the Genesis system within one minute of notification. Messages also relay information on "planned" delays due to such events as parades or road construction. Generally, Genesis users can receive up to 12 incident messages at one time. The latest information automatically "writes" over the old, so the traveler using a Genesis system is always aware of the most recent developments. Constant information updates do not, however, prompt pagers to beep and distract their carriers, as travelers access information only at their convenience.

The latest word on urban travel conditions

With Genesis, the urban traveler on the move can access reliable, real-time travel information and choose transportation modes and routes wisely.

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For Some Ears Only: Talking Signs® for Visually Impaired Pedestrians

Most blind or visually impaired pedestrians have difficulty orienting themselves in urban areas. Traditional audible traffic signals “tweet” and “cuckoo” to indicate which street has the green light. These signals are often difficult to interpret and do not orient the blind pedestrian or provide other useful information. Moreover, many sighted people find the “chirping” noises annoying.

Talking Signs® guide and orient travelers more precisely

San Francisco’s Talking Signs® store recorded voice messages on silicon memory chips and transmit the messages, via infrared light waves, from traffic lights’ pedestrian ‘WALK/DON’T WALK” signals. Pointing a small receiver (about the size of a garage-door opener) in the general direction of a Talking Sign, the user decodes these messages into speech. Each message specifies the location of the intersection, its block number, and the direction the pedestrian is facing. The status of the traffic signal (red, yellow, or green) is also broadcast intermittently. Since infrared signals are highly directional, the messages intensify as users near the transmission source, pointing the visually impaired traveler very precisely to a desired destination.

Message signs speak only on demand

Only the intended user hears Talking Signs messages, and only when he or she wants to hear them. Others do not notice the signals at all. Currently, Talking Signs are installed at 14 pedestrian crossings in downtown San Francisco. The city has installed 95 more within the subway sys-tem, guiding travelers to public-transit fare gates, boarding areas, and exits.

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Traffic Safety

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Interfacing Information for Highway Safety

Charged with monitoring roads and maintaining them in safe condition, Monroe County has its hands full, with over 1,100 centerline miles of roadway and 5,400 intersections-including the city of Rochester and numerous towns-falling within its jurisdiction. Its small investigative transportation staff needed a mechanism to identify and analyze high-accident locations and determine if any safety-enhancing traffic engineering measures could mitigate future accidents.

Linking with a state database to identify high-accident areas

The New York State Centralized Local Accident Surveillance System assigns numeric identification to roadways and intersections statewide and catalogues accident data for each location. From the state, Monroe County requests data pertaining to any accidents within its jurisdiction. The state provides a summary of accident information (by numbered location) to the county on computer disk.

Database software with powerful relational capabilities links the electronic accident information supplied by the state with site-specific local traffic counts, which the county collects both manually and mechanically. Using specialized statistical formulas, Monroe County computes jurisdiction-wide average accident rates by road classification for urban, suburban, and rural locations. These average rates are compared to the county's overall accident figures to identify high-accident-rate locations. Investigators examine accident patterns at each location and recommend measures to minimize risk.

Returning to the scene of the accident with corrective measures

Since introducing the system about three years ago, Monroe County has investigated almost 300 high-accident-rate locations and applied traffic engineering improvements to about 75 percent of the sites. Data files track the performance of these safety improvements.

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Hot Technology Braves the Cold

The Arrowhead region of northeastern Minnesota covers over 18,000 square miles. Within this highly rural area, transportation resources-both for transit and for road maintenance-are scattered, and significant communication gaps exist. Some regular transit buses, for example, routinely travel a l00-mile route. Their current local radio system-operational for about 15 minutes at the beginning of a route and another 15 at the end-cannot communicate with a central dispatch over long stretches of travel through the most remote areas.

Severe winter weather conditions, typically in force from late October through March, impact dramatically on the region. And, with only 38 snow plows in the entire northern half of the state, and 18,000 square miles to service, efficiency is paramount. Experience proves that tracking storms and sending plows out to meet them is the most effective way to control bad-weather road conditions; giving snow and ice a chance to compact before acting leaves roads dangerous and difficult to clear.

Stretching and consolidating resources to cover miles of ground

A new program, ARTIC (Advanced Rural Transportation Information and Coordination), is designed to better serve the low densities of population in the Arrowhead region. Under ARTIC, a new centralized dispatch center will coordinate communication among snow plows, state patrol cars, state Department of Transportation maintenance vehicles, transit buses, and volunteer-driver vehicles. The center will offer customer information and public transit schedules to dispel confusion among rural residents.

Communications keep rural roads safe

About half of the region's snow-plow fleet-as well as its buses and trooper cars-will be outfitted with automatic vehicle locators, enabling central dispatch to track the vehicles at all times. Plows, buses, volunteer, and trooper vehicles will also be equipped with cellular phones or pagers for communications. If, for example, a state police vehicle is stranded, a plow truck in the vicinity could locate and pick up the trooper. In short, the integrated system will allow vehicles on the road to report accidents, stranded motorists, and information on road conditions to the dispatch center. The center will, in turn, direct emergency response or other appropriate action-making everyone feel safer in this rural region.

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Toll Collection

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Freeways Take Their Tolls, Electronically

Manual toll facilities play a major role in creating congestion. The toll road of Rickenbacker Causeway, linking the island of Key Biscayne with metropolitan Miami, is no exception. During the week, there is no peak-3 hour congestion, but weekends and special events generate high-volume traffic to and from the island's landmark destinations, including Seaquarium and Crandon Park. To facilitate faster passage through the toll area for both residents and visitors, Metro-Dade County implemented an electronic toll system.

Automated toll system collects fees quickly and accurately

With transponder devices (looking much like bar codes, but essentially wireless radios) affixed to their windshields, vehicles can cruise through the toll plaza. The toll road's eight lanes are equipped with custom-designed transponder technology capable of detecting and reading information from moving sources-in this case, the number of axles on each passing vehicle, used to calculate toll fares for electronic collection-at speeds of up to 55 miles per hour. The system has a useful life of 12 to 15 years and can be technologically upgraded as needed or appropriate. Additional lanes offer customers more traditional payment options, such as paying a toll attendant or tossing coins in a basket.

Electronic toll collection improves traffic flow and cash flow

The electronic system has several advantages. Since users of the transponder devices must establish pre-paid accounts with the county, Metro-Dade collects toll revenue in advance and in greater increments, instead of dollar by dollar. The electronic system improves traffic flow, minimizes delays due to toll-collection procedures, and enhances collection accuracy and revenue projections for the jurisdiction.

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Toll-Collection Technology Pays Off

In most areas using "smart" toll-collection technology, congestion is a typical problem. Not so for the state of Oklahoma's turnpike system Nonetheless, technology makes good dollar sense for the Oklahoma Turnpike Authority.

Electronic toll-collection equipment is a breeze to operate

The authority's electronic toll system, established in 1991, employs a toll tag-known as PIKEPASS-that attaches to the lower left comer of a vehicle's windshield. About the size of a stereo cassette tape, the tag is held in place with strips of Velcro. The tag operates with radio frequencies, "talking" to antennae mounted at toll entrances and exits. The signal is read-and the toll electronically collected-as a vehicle cruises through a designated PIKEPASS lane at freeway speed. Video cameras help Oklahoma authorities enforce toll collection in PIKEPASS and coin-basket lanes. The cameras record the license plate numbers of offending vehicles, gathering instant information for a letter-and a bill-to each violator.

PIKEPASS saves money and reduces accidents

Electronic toll collection is standard on all 10 of Oklahoma's turnpikes. Today, tolls collected with PIKEPASS represent one-third of all state tolls collected. The convenience of the toll tag appeals to individuals and companies alike-25 percent of the state's PIKEPASS accounts are commercial. By making stop-and-go traffic at toll plazas a thing of the past, the system has virtually eliminated vehicle accidents in PIKEPASS lanes and slashed pollution emissions by 25 to 70 percent. The biggest payoff of operating an electronic PIKEPASS lane versus a manual toll booth? Average annual savings of about $160,000 per lane.

For more information:

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Public Safety

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For more information:

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Focusing on Neighborhood Safety

Speeding on residential streets is a concern to San Jose citizens. To impede motorists from exceeding the allowed speed of 25 miles per hour, neighborhoods have requested deterrents (such as more stop signs) or physical barriers (such as speed bumps). But these options require permanent installation and ongoing maintenance. Before committing resources to traditional traffic enforcement approaches, San Jose will put technology to the test.

NASCOP on the residential scene

Although San Jose currently uses high-resolution video cameras to observe traffic, plan for special event traffic management, and respond to incidents, the city has not used cameras for enforcement purposes. The Neighborhood Automated Speed Compliance Program (NASCOP) test will use a "smart" video technology to monitor residential speeding. (Assigning conventional "speed traps" to low-volume neighborhood streets is rarely an efficient use of equipment or manpower. Besides, when radar guns detect speeding violations, police must pursue, stop, and cite the offending motorist-a procedure that puts officers out of commission for 20 minutes or more, preventing detection of other offenses.) NASCOP is a photo radar device installed in a mobile unit and operated by a specially trained staff person instead of a police officer. The device records the speeds and license-plate numbers of offenders; later, the city establishes contact by mail. Since there is no on-the-scene pursuit, NASCOP is on continuous duty: no down time interferes with surveillance.

Determining technology's effectiveness

Surveys will measure speeds on select residential streets prior to implementation of the four-month NASCOP experiment, during the test, and after NASCOP's highly visible presence in the community. The data will be compared and differences measured to determine the effectiveness of the speed-compliance program. If the technology slows residential traffic to an appropriate and safe speed, the unmanned video camera may prove the ideal neighborhood "watchdog."

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Help at the Touch of a Button

MAYDAY systems for travelers address increasing public concern for personal safety on the highway. Such devices, which enable those encountering trouble on the road to send immediately for help, offer travelers a better chance of surviving accidents, mechanical failures, and carjackings.

Tests evaluate pager and cellular MAYDAY devices

The Puget Sound Help Me (PUSHME) operational test is evaluating two devices: a two-way pager and a cellular telephone, both equipped with special features. The two-way pager offers three buttons: one for emergency situations, one for medical help, and a third for mechanical assistance. The pager device cannot transmit voice, but two-way communication is possible if a traveler pushes buttons in response to digital messages or questions. The cellular telephone, by contrast, offers two-way voice communications. Its primary MAYDAY feature is a silent alarm panic button activating a voice link that is monitored until help arrives on the scene Users can push other buttons to identify a situation as an accident, a need for mechanical assistance, or a request for directions.

Devices locate the traveler to dispatch immediate assistance

Crucial to getting help to the traveler is knowing where to find the per-son. Often the individual experiencing an emergency may not even know where he or she is, let alone be able to direct help to his or her location. Once activated, each of the MAYDAY devices under testing in Puget Sound automatically transmits a signal to a 3-l-l dispatch center, where an electronic map pinpoints the signal location-usually within 30 feet, Precise location of the traveler in trouble enables rapid emergency response.

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Technology Speeds to the Rescue

Fielding an average five million emergency calls each year overwhelmed Chicago's outdated manual 9-l-l system. Taking its place is a new, state-of- the-art facility integrating the most advanced technology.

Mapping the city for better communications and response

To make the transition to a hightech 9-l-l system, Chicago created an extensive database and electronic map of the city. The database catalogues detailed information on Chicago's citizens, recording medical conditions, disabilities, and language preferences.

A giant electronic map at Chicago's 9-l-l headquarters-including over 20,000 street segments, some 20,000 alleys, the locations of fire hydrants, and footprints of almost one million buildings-will track, in real time, the exact location of fire and rescue vehicles. The map can show the entire city or zoom in for a close-up 16-block view. Since police officers often leave their cars in response to a call, the map represents their vehicles at their last dispatched locations. Over time, as portable locator technologies become more cost-effective, the map will track not only the where-abouts of police vehicles, but also those of officers themselves.

Technology serves the public well

The new, fiber-optic 9-l-l communications system boasts a vastly greater capacity for simultaneous calls-speeding the response of emergency vehicles. The new system also provides automatic phone-number-and-address identification of each call, thereby improving emergency vehicle assignment and routing.

As 9-l-l calls are received by the center, a computer automatically routes them to fire or police dispatchers and identifies the available vehicle closest to each scene. Dispatchers can approve or override the computer's instant routing decision.

On the scene, Chicago police are testing other technological tools. One tested device is a hand-held minicomputer that scans and reads magnetic- strip driver's licenses, allowing a police officer to turn his or her full attention to a suspect while-within seconds-local, state, and national crime databases are accessed and the suspect's license evaluated against the crime data.

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Success Stories

Comprehensive

Going for the Cold 29

The Atlanta region has experienced phenomenal growth in the past 20 years. In the summer of 1996, the city of Atlanta-the region's economic engine and one of the nation's most progressive cities-will capture world attention as host of the Olympic Games. Thousands will flock to the area for what is expected to be the largest peacetime event in history. With efficient transportation systems, Atlanta will be ready for them.

Mapping for mobility

At the heart of Atlanta's advanced transportation technology are geographic information systems (GIS)-very sophisticated, high-tech maps. These electronic maps will reflect up-to-the minute information on regional roadway conditions and traffic patterns, gathered, in part, by Metropolitan Atlanta Rapid Transit Authority buses equipped with advanced vehicle locator systems. (The locators transit, via satellite, the buses' exact locations at any given moment; by tracing the positions of late-running buses, the GlS map can pinpoint congested areas.) "Smart" cameras on the ground will also monitor traffic volume and flow. Other transportation management tools will include a network of computerized signal controls, ramp meters, and variable message signs. Visitors to the Olympic Games will benefit directly from Atlanta's new transportation technologies. With events spread out over a wide geographic area, travelers will need clear information to move from one event location to the next. To meet their needs, Atlanta will make advanced, up-to-the minute information on driving conditions and mass transit options accessible from kiosks, cellular phones, notebook computers, and local cable television.

Cooperation improves quality of life

Designed with an open architecture, Atlanta's transportation management system readily accommodates changing technology and integrates easily with other systems across the region and the state, thanks to the city's strong cooperation with surrounding counties and the Georgia Department of Transportation.

But the system's benefits transcend transportation. With real-time knowledge of traffic conditions, Atlanta's GIS map can plot the fastest route to an emergency scene for fast fire or police response. improving traffic flow and reducing stop-and-go congestion also benefit the area and the planet. According to Atlanta's estimates, a centralized traffic approach could reduce polluting vehicle emissions by 15 to 20 percent and fuel consumption by over 16 percent

For more information:

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Taking Solutions to the Streets 30

Texas has a reputation for "big": big state, big sky, big wide-open spaces. In recent years, however, even Texas has begun to face limitations on space and resources. As one of the nation's major travel corridors, the thriving city of Houston and surrounding Harris County have recognized and accepted the fact that cost and environmental concerns now restrict physical improvements to existing transportation infrastructure. Every day 100,000 people travel to the Texas Medical Center, and thousands more visit the Astrodome to watch the Houston Oilers or enjoy other special events. To meet congestion and pollution challenges, the city of Houston, Harris County, the area's Metropolitan Transit Authority, and the Texas Department of Transportation have joined forces to establish the Houston Intelligent Transportation System.

Technology stretches dwindling resources

Technology will play a key role in the area's advanced transportation management system, providing real-time information about actual travel conditions. A network of fiber-optic lines will link computerized traffic signals, roadway sensors, video cameras, changeable message signs, and incident detection systems. The information gathered will help commuters make intelligent transportation choices.

Along major highways, high-occupancy vehicle (HOV) lanes are under construction. Buses, carpools, and vanpools will be granted access to these less congested-and faster-traffic lanes, Using an automatic vehicle identification system and closed-circuit television, the traffic control center will monitor access to the lanes and manage remote-controlled barrier gates, changeable messages, and signals. More than 1,300 traffic signals along bus-route streets will be computerized to communicate with one another; eventually, that number will grow to an estimated 2,800. Buses will be able to preempt these "their schedule Emergency vehicles will also enjoy priority smart" traffic signals in order to maintain signal privileges.

Changing behavior with information

One major prong of Houston's intelligent transportation effort will encourage commuters to use mass transit instead of the costly one-person-one-car approach so ingrained in American culture. Yet for high-occupancy modes to be attractive to passengers, travel information must be clear and up-to-date, and choices convenient, quick, and easy on the wallet. Houston's advanced transportation management system will offer information on bus schedules, routes, costs, and real-time status via kiosk, personal computer, and touch-tone phone. In areas that are not well served by bus routes, a rideshare matching service will encourage carpooling by taking the logistical hassle out of the process. These and other technological advances in the Houston area will benefit community, business, and environment for years to come.

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On the Fast-Trac to Economic Health

In Oakland County, residential population and local business activity sky rocketed about one decade ago. Hand-in-hand with the good news came the bad: traffic congestion and roadway deterioration. Addressing those problems carried an estimated pricetag of almost $1 billion. With over 2,500 miles of major county roadways and state highways in the northern suburbs of metropolitan. Detroit under its jurisdiction, Oakland County decided that the "old" way of solving transportation problems was no longer feasible.

Necessity is the mother of invention

What emerged from Oakland County's hard thinking was a more innovative approach: the Faster and Safer Travel through Traffic Routing and Advanced Controls (Fast-Trac) system. Today, with over $70 million committed, it is the largest operational test of intelligent transportation systems in the world. The program integrates advanced traffic management with advanced traveler information systems.

At the core of traffic management is the Sydney Coordinated Adaptive Traffic System (SCATS), which operates traffic signals in real time and adjusts them automatically to reflect changes in traffic flow, incidents, and accidents. Video sensors enhance the data-gathering capabilities of the computer-based traffic signal-control system. (Oakland County chose video sensors over more conventional inductive loops for several reasons. For starters, the video devices can be installed on any surface and important for Michigan in any kind of weather. Also, one video camera can survey several traffic lanes at a time. Loop detectors, on the other hand, must be installed within roadways-tearing up pavement and restricting work to mild weather-and only one to a lane.)

At the traffic operations center, monitors display the overall traffic "picture," including signal operations, information from video detectors, and congestion levels. Maintaining its own database of information, the system eliminates the need for traditional traffic-count studies and makes data instantly available for economic forecasts and other planning.

Impressive "in-roads" in mobility and safety

Fast-Trac has been successful on several fronts. At the World Cup soccer matches held in Detroit's Silverdome-and since then, at other major concerts and special events-tests showed that the traffic management system eased traffic flow and reduced the need for police to manually direct traffic.

Overall, the program is responsible for a 19 percent increase in rush-hour travel speed and a significant decrease in accidents. Studies suggest that Fast-Trac could potentially reduce the average number of vehicle stops by one-third, decreasing the incidence of rear-end collisions and slashing carbon monoxide emissions to the environment by 12 percent. Already, instituting a "leading" left-turn signal at intersections has reduced the number and severity of left-hand and head-on accidents; eventually, pedestrian priority signals at school crossings will minimize risks to children's safety.

By making optimal use of its existing roadways, Oakland County is taking the fast track to a healthier community. The jurisdiction is saving money, attracting residents and businesses, and preserving its woodlands and lakes for future generations to enjoy.

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